

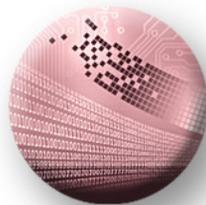


## **Greg Laue – Director of Aerospace Products**

### **ManTech/Nexolve**



Systems Engineering  
& Integration



Information  
Technology



Intelligence Analysis  
& Mission Operations



Global Logistics & Supply  
Chain Management

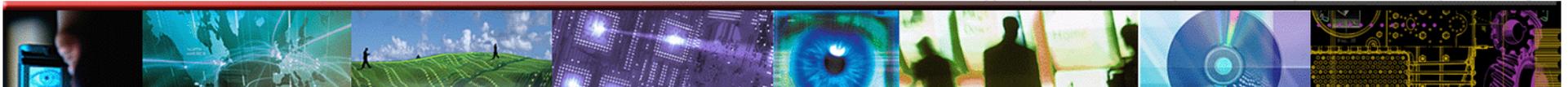


# Project Management and Product Quality in Lean Organizations

## ManTech International Corporation

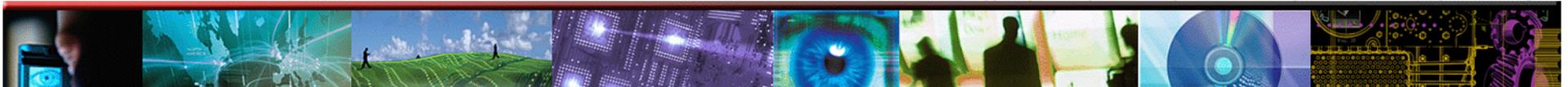
Greg Laue – Director of Aerospace Products, JWST Sunshield Program Manager

Greg Farmer – ManTech/Nexolve Program Assurance Manager



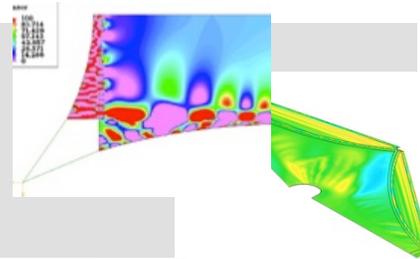
## The “odd couple” of lean organizations – Project Management and Product Assurance

1. Characteristics of a lean organization – or at least characteristics of our lean organization.
2. Characteristics of good odd couples
  - Oscar and Felix – stuck together by circumstance
  - The Other Guys – the big challenge and the long haul
  - Sheldon and Leonard – Keep a good “roommate agreement”
3. Key is to grow from the natural give and take between the “doer’s” and the “don’t do that’ers” in the organization.



## Advanced Materials and Thin Film Technology

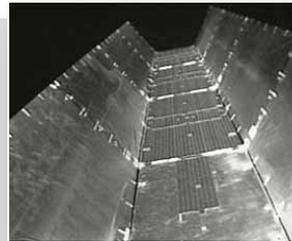
- Membrane System Thermal Modeling
- Membrane system FEA design



***Strain (Thermal)  
Tolerant Design***

## High Performance Lightweight Reflectors

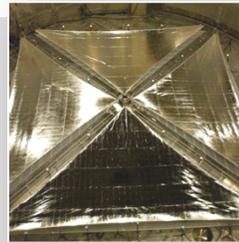
- PV Array power boosters
- Inflatable concentrators
- Directed energy reflectors



***Construction  
simplifications and  
elimination of  
component count***

## Large Light-weight Deployable Membranes

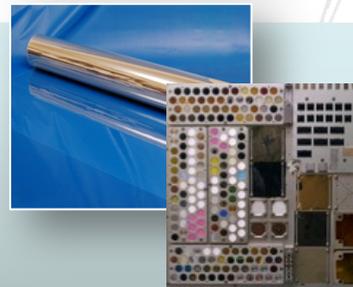
- Solar sails
- Flexible circuits
- Pathfinder airships



***Large Scale  
manufacturing  
techniques – gores,  
seams and testing***

## Ultralight High Performance Coatings and Polymers

- “Thinner than min-gauge”  
(2-5 micron thickness vs 25-75)
- Space mirrors on thin films
- Qualification and Testing



MISSE Experiment Bay on the ISS

***Complete in-process  
testing and  
qualification program***





Civic leaders were given a close-up look at a prototype of the giant membranes that will shield the Webb telescope from the sun. From left, Joe Aho and Blake Bullock, both with Northrop Grumman, listen as John Cranston, senior production engineer with ManTech, shows them a 1/10th scale model of the membrane with a 10-scale model of a person in the middle. The actual membrane is draped behind them. (The Huntsville Times/Dave Davis)

## A shining example of engineering skill

Thinner than a hair and as big as a tennis court, one-of-a-kind membrane will protect billion-dollar replacement for Hubble

By Leo Rupp  
leo.rupp@hunts.com

Huntsville's workweek started Monday with VIPs viewing a sunshield designed to protect a telescope a million miles from Earth and the gold-coated mirrors that will let that telescope see galaxies from near the beginning of time.

In other words, the visiting VIPs were told, it's just another day in Cummings Research Park doing "something that's never been done."

The visitors were at ManTech International seeing a full-size lamppost of one layer of the sunshield that will protect the James Webb Space Telescope in orbit. ManTech will eventually build five of these layers for the Webb.

Thinner than a human hair and the

Watch a related video at [al.com/webb](http://al.com/webb)  
Find more photos at [al.com/topshots](http://al.com/topshots)

size of a tennis court, the test shield was suspended in a clean room a few hundred yards from Old Madison Park and Bridge Street Town Centre.

The Webb telescope, successor to the Hubble and 100 times more powerful, is requiring a steady stream of components "lighter, stronger and built to tolerances never seen," according to Keith Parrish of the Goddard Space Flight Center, Webb observatory manager.

"A company down here in Huntsville

had some really good ideas about how to do that," Parrish said of the shield part of the puzzle. "ManTech established the state of the art. What you will see today has never been built before."

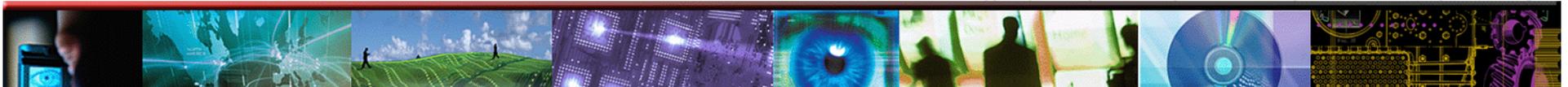
What the dignitaries saw was a micro-thin membrane made from Kapton, a high-performance plastic with a reflective aluminum coating. The final five-layered shield will be able to protect the infrared telescope from both the sun's light and heat.

The Webb team is fighting more than complex technical challenges. Critics in Congress this year suggested killing the project - which has gone over budget \$1.5 billion by some estimates - but a Senate committee put funds for the Webb in next year's

See SHINING on A10

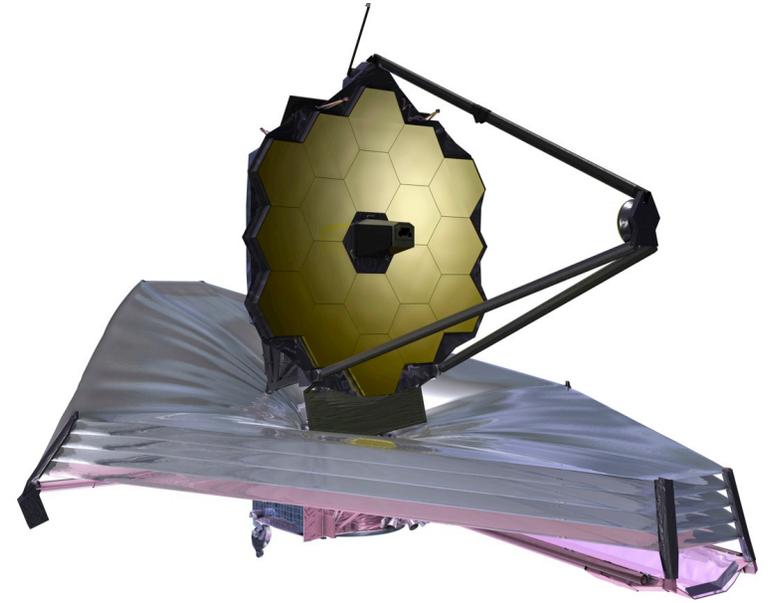
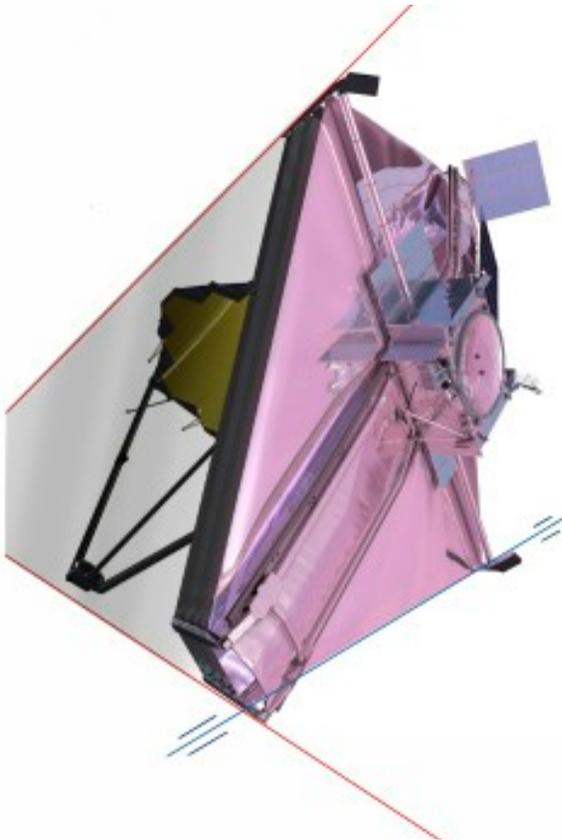
- **NeXolve certification: ISO 0991:2008 + AS9100C**
  - AS9100C is the Aerospace Standard for Quality Management Systems – Requirements for Aviation, Space and Defense Organizations
  - Current certification issue date: September 19, 2012
  - Expiration date: September 17, 2015
  - Annual maintenance audits required, re-certification required every 3 years
- **Certification covers:**
  - Design, fabrication, and assembly of sophisticated polymer membrane film structures, sunshields and membrane structures for spacecraft thermal control and power generation, and manufacturing specialty polymer resins.
- Three registered sites in Huntsville:
  - 655 Discovery Drive, 355 Quality Circle, 290 Dunlop Blvd.

September 2011 – Huntsville Times



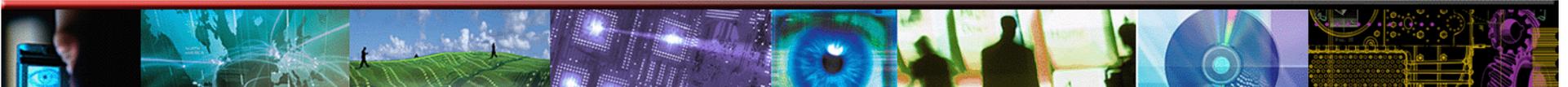
## Mission (Passive Thermal Protection):

- 1.) Shade optics
- 2.) Reject heat through edges.



## Very Challenging Design Space:

- Cleanliness Requirements
- 1G (ambient) to 0G (Cold) thermal change
- Interfaces and Exclusion zones
- Co-aligned edges
- Continuous (no contact) separation between layers



## Example - Challenges of Invention to Implementation to Flight



**Full-Scale Flight Seams – a beautiful thing!**

**2004**

- *Invented and reduced to practice with 3 related Patents granted*

**2005 to 2008**

- *Development/refinement and infrastructure implementation*

**2009 to 2010**

- *Process design fully defined, process controls and process space fully explored.*

**2011 to 2012**

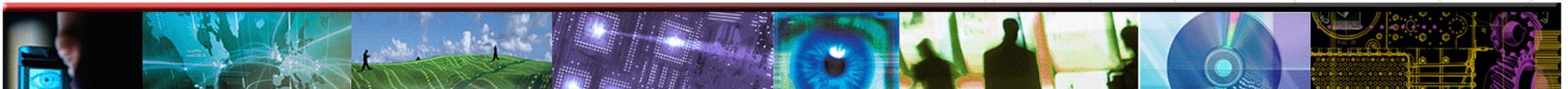
- *Flight Proto-type fabrication and dress rehearsals*

**2012/13**

- *Flight Process Qualified*

**2013**

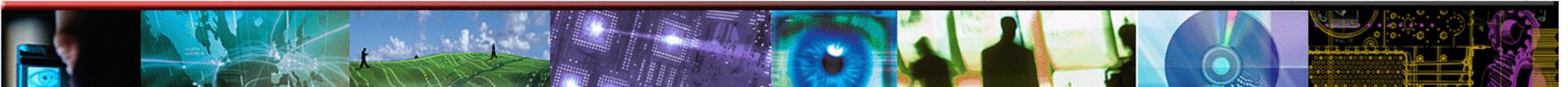
- *Flight Manufacturing Begins!*



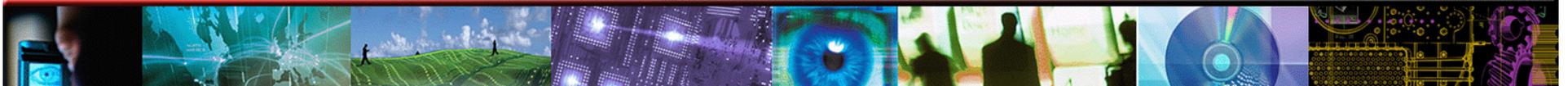
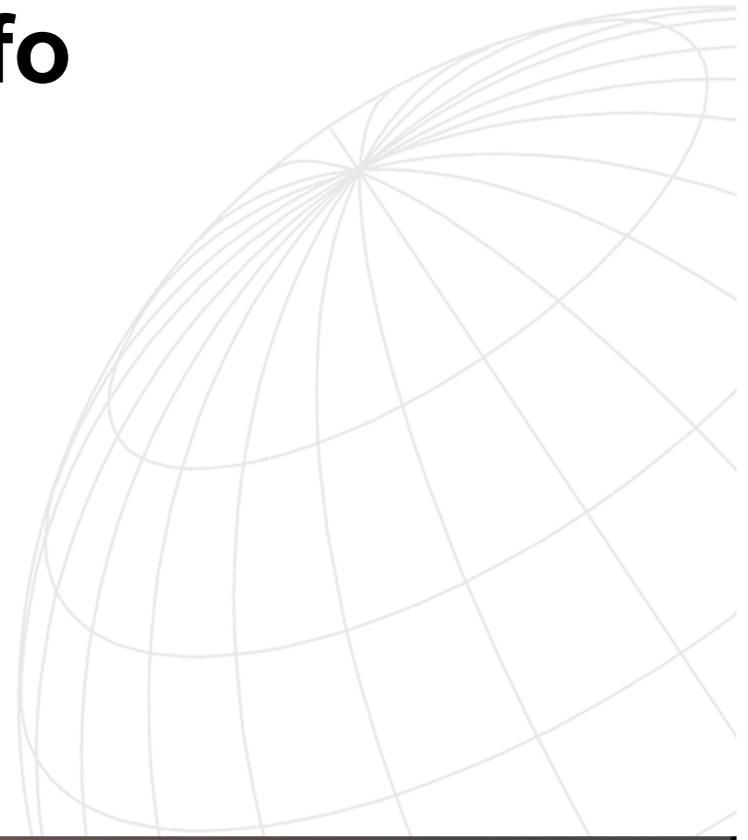
# JWST Development and Accomplishments



**1<sup>st</sup> Completed Full-Scale Flight Template -  
September 2011  
*3 more completed since.***

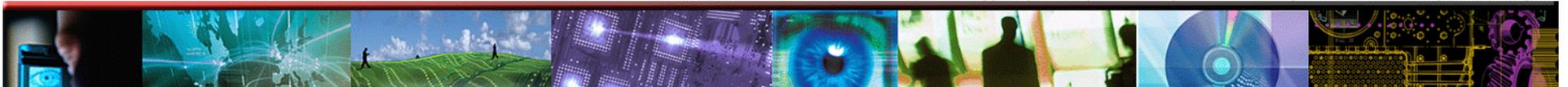


# Back-up Info



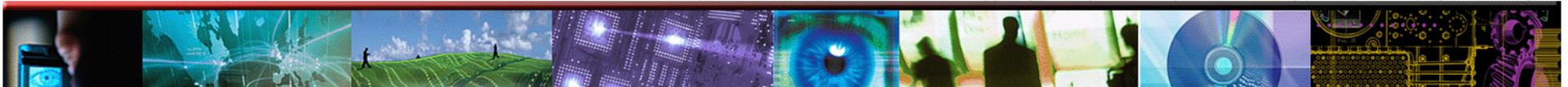
## How do your organization's handle / fulfill the differing or divergent requirements coming from your customers?

- NeXolve is an solutions based provider, therefore we deal with differing and divergent (customer specific) requirements on most product developments
- We control our fundamental requirements through our approved and controlled "Process Control" documents (MATDs)
- We control differing requirements through our detailed work instruction documents (travelers)
  - Unique, released, and controlled documents
  - Control fabrication from component to assembly level
  - Controls re-works, repairs
  - Engineering, Manufacturing, and QC hold points integrated into the work instruction documents



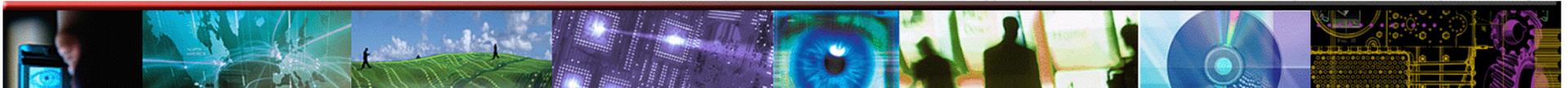
## How do you manage the transition from development to production in a way that assures quality product?

- During initial development activities engineers are given the freedom to develop “best” solutions, with minimum QA/QC oversight
- Engineers and technician are responsible for documenting process and workmanship details discovered during the development trials.
- When concept evolves to engineering model (prototype) level the following documents are required:
  - Draft process controls (MATDs), engineering redlines permitted
  - Draft work instructions (Travelers), engineering redlines permitted
- QA/QC involved in the process at the “draft” document level
- Prior to start of “first unit” fabrication/production process control and work instruction documents released under configuration management
  - These documents ensure requirements and quality compliance of the product



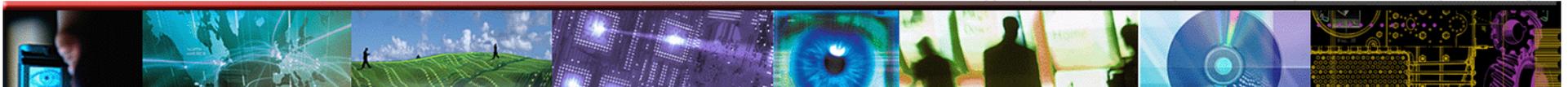
## **Do lean organizations have a built-in advantage in effective teamwork across project/organizational disciplines and roles? And what do you do to assure sound teamwork?**

- The built-in advantage is the cross-discipline interactions required for a successful lean organization
  - Personnel are responsible for multiple functional roles which allows team members to be engaged in multiple phases of a development
  - Promotes an integrated understanding of key technical and programmatic requirements and objectives
- The net result of this combined knowledge fosters cooperation and team unity
- The cross-discipline roles must be managed closely to prevent functional conflicts of interest
  - Roles and responsibilities must be clearly defined and understood by all



## Overall, what are the major advantages/benefits and challenges/risks of being a lean organization?

- Decision making and organizational communication is streamlined and therefore very efficient
  - Information gathering is streamlined
  - Access to technical and programmatic leads is streamlined
  - Opportunities for cross-discipline interactions are streamlined
- Issues are identified and disseminated to the team quickly and effectively
- Functional conflicts of interest can become an issue when program or technical pressures occur
- Single point dependency on key technical or programmatic personnel can be a risk
- QA/QC personnel must be given adequate authority (and support from management) when quality issues conflict with program resource issues.



## And of course the ever popular audit question -- How do you assure the independence of your mission/quality assurance

- The QA Manager reports directly to the site General Manager
  - Reports on QA functional performance, audit results, issue resolution, etc.
- QA functionally reports to the Program (Mission) Assurance organization
  - PA manager must ensure PA technical or programmatic responsibilities “do not” interfere with QA/QC responsibilities
- QA and QC personnel are given full authority to “STOP” work activities during any controlled phase of a development or production cycle.

